



TUNDRA TREATMENT GUIDELINES

A Manual for Treating Oil and Hazardous Substance Spills to Tundra

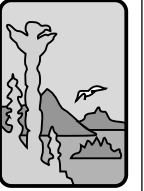
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FOREWORD

Tundra Treatment Guidelines: A Manual for Treating Oil and Hazardous Substance Spills to Tundra was conceived and funded by the Alaska Department of Environmental Conservation, Division of Spill Prevention and Response, Prevention and Emergency Response Program, and is based on over 25 years of combined industry, university, and government agency experience with tundra spills and field experiments on Alaska's North Slope. Nevertheless, controlled long-term studies of the effectiveness of the tactics contained in this manual are largely non-existent, and we intend to modify this manual as more information becomes available.

The purpose of this manual is to provide a menu of tactics which can be used to treat and monitor tundra impacted by spills of crude oil, petroleum products, seawater, and other substances after initial response efforts have eliminated the threat of large-scale spill migration. Each tactic is numbered with a key letter to identify the subject: P (Planning), T (Treatment), and AM (Assessment and Monitoring). An extensive bibliography of references used to determine the appropriateness and effectiveness of various treatment tactics is included at the end of this manual.

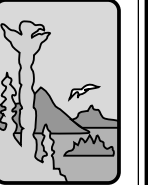
This manual is intended to provide a framework for identifying treatment goals, selecting tactics, and assembling an overall tundra treatment strategy. Emphasis is placed on developing treatment strategies that reduce toxicity, mobility, and volume of spill residuals in tundra to allow revegetation and control risks to wildlife, aquatic, and human receptors, while at the same time protecting sensitive tundra soils from physical damage and induced thermal effects.

Justification of the use of various tactics with spills of various substances to tundra is given in the companion manual, "Tundra Spill Cleanup and Remediation Tactics." This manual examines historical spills to tundra and summarizes what treatments have been effective in various types of tundra in winter and summer.

COVER PHOTO SERIES

(Unpublished photos by Jay D. McKendrick documenting recovery of a wet tundra site at Prudhoe Bay following a crude oil spill in 1972. This photo series illustrates how appropriate use of treatment tactics such as seeding and fertilizer can decrease recovery time.)

1. 1977: The spill has aged six growing seasons, and it has been three growing seasons since phosphorus fertilizer was applied to test plots and native grass seed (*Puccinellia arctica*) was applied to the entire site. The *Puccinellia arctica* is well-established and confined to the phosphorus-treated soil, even though seed was applied to the entire spill area.
2. 1985: The spill has aged 14 growing seasons, and the seeded *Puccinellia arctica* has been replaced by *Carex aquatilis* and *Dupontia fischeri*, two indigenous species that have naturally recolonized. Note how these invading species concentrate in the phosphorus-treated soil.
3. 1993: The spill has aged for 22 growing seasons, and the naturally recolonizing tundra plants have expanded beyond the margins of the fertilized plots, which are now 19 growing seasons old.
4. 1997: After 26 growing seasons, the naturally recolonizing plants have almost completely occupied the polygon basin affected by the spill. The seeded grass is entirely absent.



DISCLAIMER

There are always site-specific and incident-specific conditions beyond the control of persons treating spill-impacted tundra which may affect treatment performance. Accordingly, it is impossible to guarantee treatment performance in exact accordance with any estimates, strategies, or scenarios presented in this manual. Safety of site workers and the public is the highest priority in all situations and should supersede all other considerations in treatment operations.

Some graphics and text in this manual are adapted from *The Alaska Clean Seas Technical Manual*. In producing *The Alaska Clean Seas Technical Manual*, Alaska Clean Seas (ACS) endeavored to provide the best available information based on the latest technological and engineering advancements. ACS believes that the information and procedures contained in the *ACS Technical Manual* are well founded; many of the procedures are based on actual experiences in the environments where these procedures are intended to apply. Nonetheless, ACS and its members expressly disclaim that the procedures provided in the *ACS Technical Manual*, even if followed correctly and competently, will necessarily produce any specific results. Implementation of the recommendations and procedures contained in this manual and the *ACS Technical Manual* is at the sole risk of the user.